WOOD RIVER SCULPIN (COTTUS LEIOPOMUS): ABUNDANCE AND DISTRIBUTION ON PORTIONS OF THE KETCHUM RANGER DISTRICT OF THE SAWTOOTH NATIONAL FOREST AND THE SAWTOOTH NATIONAL RECREATION AREA

Wood River sculpin (*Cottus leiopomus*):

abundance and distribution on portions of the Ketchum Ranger District of the Sawtooth National Forest and the Sawtooth National Recreation Area

Final Report to:
Idaho Department of Fish and Game

and

Sawtooth National Forest

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The Wood River sculpin (Cottus leiopomus) is endemic to south-central Idaho. It is considered a sensitive species by the U.S. Forest Service in Region 4 and is an Idaho Department of Fish and Game species of special concern. However, no previous comprehensive studies of its distribution within the Wood River system have been completed. In addition, little is known about the habitat use of the Wood River sculpin and their abundance in relatively undisturbed habitat.

The overall objective of this study is to gain knowledge of the distribution and abundance of the species, especially in the Big Wood River and Little Wood River drainages on the Ketchum Ranger District and the Sawtooth National Recreation Area, in summer 1996. Additional specific objectives were to:

a) assess sculpin abundance and habitat characteristics in locations that are representative of Desired Future Condition (DFC) streams,

b) determine the upstream limits of sculpin distribution in headwater tributaries and evaluate physical factors setting those limits.

c) evaluate the extent to which sculpin density varies with stream gradient, elevation, and width and with sub-basin bedrock as indexed by water conductivity.

Study methods

Sculpin were collected by electrofishing. Because sculpins do not involuntarily swim toward the positive electrode when an electrical field is generated in water, the effectiveness of the technique may be reduced. Also, they lack a swimbladder and are therefore heavier than water; after losing equilibrium in the electrical field they only drift with the flow of water for short distances before settling to the bottom. Despite these complications, electrofishing was the only feasible collection method for the study.

At each site, a blocknet first was placed at the downstream end. An upstream blocknet was initially used but later discontinued and replaced by a practice of establishing the upper site boundary in habitat (usually very shallow) that was not occupied by sculpin. Electrofishing with a gasoline-powered unit (Coffelt Mark-10 CPS) producing 0.6-1.5 amperes (at 200-400 volts DC, depending upon water conductivity) was then begun immediately in an upstream direction. From one to three additional crew members moved a few feet behind the electrofisher, positioning a set of 1/8 inch mesh dip nets on the bottom to intercept at all times at least half (usually more) of the stream flow. Larger sculpin were usually sighted by the crew before they were netted, but smaller fish were seldom noted in this manner. At the conclusion of one complete pass through the site, the blocknet was carefully removed and the fish that were trapped in it were collected. The net was immediately re-set at the same position.

A three-pass removal technique was employed, with the procedure described above being repeated twice more with no unnecessary time elapsing between passes. All sculpin collected in each pass were held separately and enumerated, measured to the nearest millimeter (total length), and released following the third pass. Sculpin population estimates and 95% confidence intervals were calculated by the MicroFish 3.0 computer program (Van Deventer and Platts 1989). Densities were expressed as the toal number of sculpin (of all sizes) per 100 ft^2 of stream surface.

Records were also kept of other species of fish and of amphibians that were captured or observed at each site.

Site length was kept short (typically 100 feet or less), especially if sculpin were abundant, to minimize sampling error. Most streams and reaches were designated by Sawtooth National Forest personnel: specifically, these were the four DFC streams (Fox Creek and Coyote Creek on the upper Big Wood River, upper Deer Creek below Ketchum, and the upper Little Wood River above Grays Creek). Also specified by Sawtooth personnel were Warm Springs reaches and Lake, Senate, Owl, and Baker creeks. I also included upper Trail Creek and tributaries Wilson and Corral creeks, Eagle Creek, East Fork Big Wood River sites, and additional upper Big Wood River sites.

Electrofishing sites were selected to include previously established (i.e., Beneficial Use Reconnaissance Program of the Idaho Division of Environmental Quality) sites, if available. If

not, the entire length of stream was first examined and sites representing typical habitat were established throughout that length. At seven streams, sampling continued upstream until the upper limit of sculpin distribution was established.

Water temperature was spot-checked at time of sampling, and typically (with the exception of Lake Creek) was 8-13 C at mid-day in July and August. Water conductivity (in micro-Siemens) was measured with a field meter (model FS/C II) that was not temperature compensating, but the relatively consistent temperatures experienced should have provided minimal bias. Substrate was typically variable within a site, and it was beyond the scope of the study to take systematic substrate measurements. Stream gradient at each site inhabited by sculpin was estimated from topographical maps.

Streamflow in spring and early summer of 1996 was above normal due to a heavy snowpack, and sampling was not feasible in June. Sampling began on 1 July, but most was deferred until mid-July when flows reached base level. A few sites were sampled two or three times to assess possible changes in abundance. Sampling concluded on 6 November.

Results

A total of 63 sites were sampled from 1 July through 6 November 1996 (Appendix 1). Wood River sculpin (referred to throughout the remainder of the results section as "sculpin") were absent from 20 sites on 17 streams, with many of these sites located at the headwaters of streams containing sculpin at their lower reaches. Sculpin were apparently completely absent from some tributaries to:

Deer Creek (Kinsey Creek and North Fork Deer Creek)

East Fork Big Wood River (Cove Creek and Federal Gulch Creek)

Warm Springs Creek (Barr Gulch Creek and Red Warrior Creek)

Little Wood River (Mormon Gulch Creek and Slide Canyon Creek)

In most of these eight situations, however, sculpin were present (and abundant) in the main stems at the mouths of each tributary, in some cases only a few yards away.

The eight streams apparently not inhabited by sculpin were small and shallow, with mean widths ranging from 1.2 to 6.3 feet. Headwater sites not occupied by sculpin (but where sculpin were present below) were typically small, but a few such as the East Fork Big Wood River near the Mascot Mine were as wide as 20 feet (Figure 1).

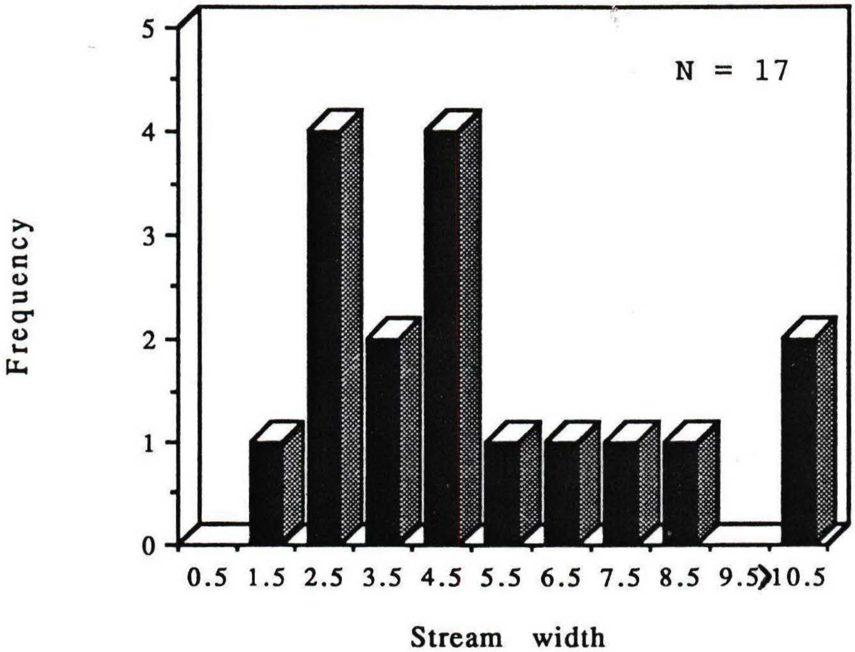


Figure 1. Average width of Sawtooth National Forest stream sites sampled in 1996 that were not inhabited by Wood River sculpin.

Summer sculpin densities and summer habitat characteristics

Wood River sculpin densities at the 43 sites where they were present ranged from < 0.1 to 28.4 individuals/100 ft^2 (Appendix 1). At 31 (72%) of those sites, densities were below 5.0 individuals/100 ft^2. Six sites held densities of 5.1-10.0 fish/100 ft^2 and five held 10.1-20.0 fish/100 ft^2. At one site (Lake Creek), density exceeded 20.1 fish/100 ft^2 but that density might have resulted from special circumstances (see below).

Stream width at those sites inhabited by sculpin ranged from 3.2 feet (Senate Creek) to 21.0 feet (Little Wood River above Ironmine Canyon). Sculpin density was not correlated with stream width ($r^2 = 0.01$, Figure 2).

Channel gradient at sites where sculpin were found ranged from 1.1% (Deer Creek at Wolftone) to 7.6% (Left Fork Placer Creek), although only two sites had gradients of 6% or greater (Figure 2). Sculpin density was not correlated with channel gradient ($r^2 = 0.04$).

Elevation at sites where sculpin were found ranged from 5840 feet (Deer Creek at Wolftone) to 7840 feet at Baker Creek. Sculpin density was not correlated with site elevation ($r^2 = 0.05$, Figure 2).

Water conductivity ranged from 26 uS at Coyote Creek to 401 uS at Eagle Creek. Of the physical attributes measured, conductivity was the strongest predictor of sculpin density ($r^2 = 0.30$, Figure 2). Streams draining watersheds with substantial calcareous composition (Eagle Creek, Lake Creek, Senate Creek,

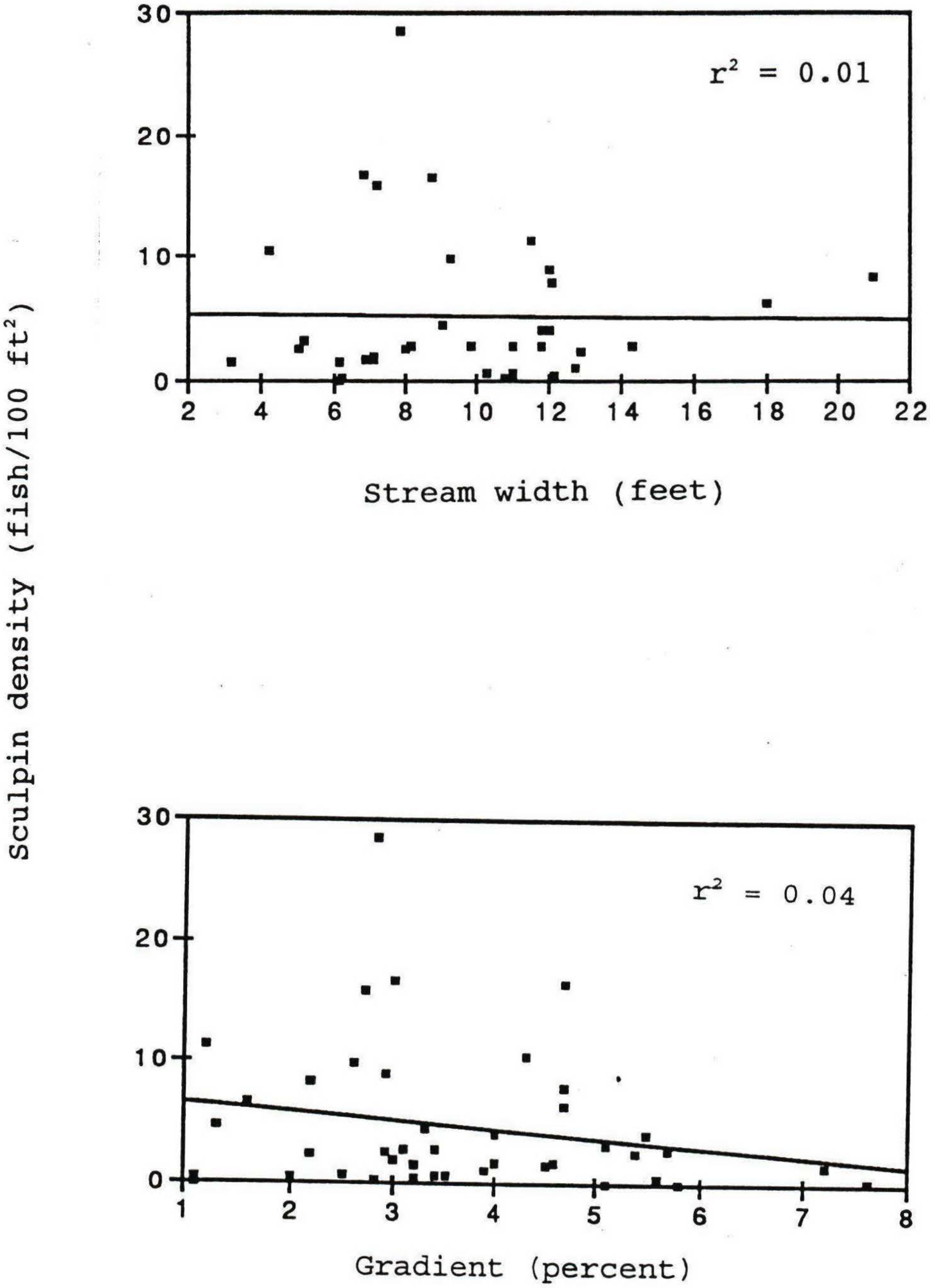


Figure 2. Linear correlations of stream width, gradient, elevation, and conductivity with density of Wood River sculpin.

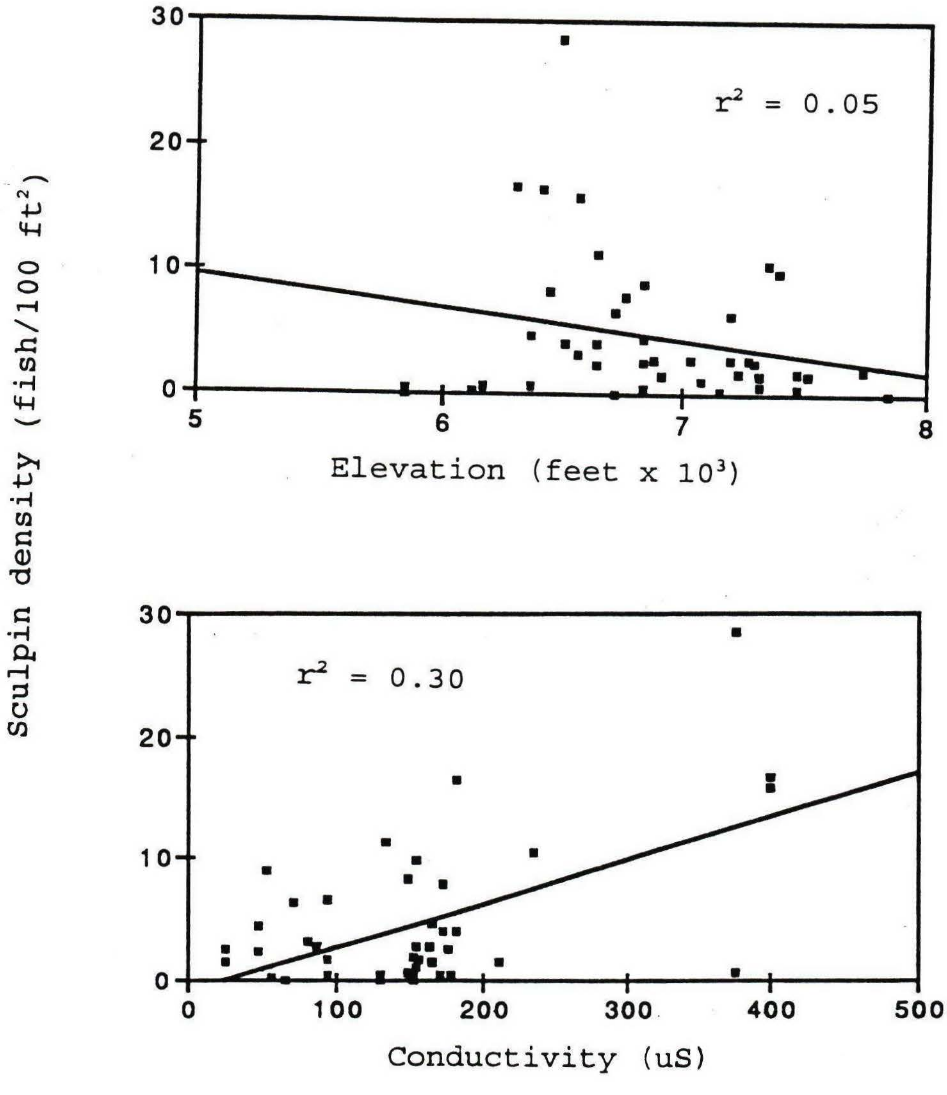


Figure 2. continued

and to a lesser degree upper Trail Creek and its tributaries, (Wilson and Corral creeks) held the highest sculpin densities.

Because stream habitat varied considerably within each site and microhabitat data (describing habitat attributes at the location of each fish) were not collected, only general observations can be made on summer habitat use. Levels of fine sediments were generally low at the sites, but sculpin density declined within a stream where embeddedness increased (see Little Wood River site, next page). Locations where substrate was smaller than ca. 4 inches in diameter seldom held sculpin larger than ca. 60 mm. Water velocity (often correlated with substrate size) slower than an estimated 1.5 feet/second and faster than ca. 3 feet/second appeared to provide sub-optimal habitat for adult sculpin.

Prelminary observations suggested that water depth was an important habitat attribute. Sculpin larger than young-of-the-year appeared to avoid water shallower than ca. 4 inches deep regardless of substrate size or velocity.

The largest individual sculpin at a site were consistently collected from along streambanks in association with structure such as boulders and/or large woody debris. Otherwise, however, adult sculpin were most abundant in deeper water along the thalweg and did not appear to be closely associated with bank habitat in summer.

Desired Future Condition streams

Overall, sculpin densities in upper Deer Creek, Fox Creek, Coyote Creek, and upper Little Wood River were within the range found at other study sites. Upper Deer Creek, Fox Creek, and upper Little Wood River sites were similar in conductivity but very different in sculpin abundance. Only two sculpin were collected at three sites on Fox Creek, yet they were abundant in the Big Wood River a few yards downstream, with no apparent impediment to their upstream movement at the confluence. Other streams as small as Fox Creek were typically not inhabited by sculpin.

Sculpin density in upper Deer Creek was consistently low. Summer habitat appeared to be of high quality for sculpin, but densities were always less than 1.0 fish/100 ft^2. Although winter habitat might be sub-optimal (see below), these consistently low densities were the most anomalous of any collections made during this study.

Coyote Creek was characterized by the lowest conductivity encountered in the study that reflects its granitic/dacitic lithology. The size of substrate particles, especially at the middle and upper sites, was small, with no cobble > 3 inches in diameter. Nevertheless, the stream held intermediate densities (1.5-6.5 fish/100 ft^2) of sculpin.

Analysis of the upper Little Wood River above Grays Creek was hampered by its relative inaccessability, especially so for medium-sized tributaries. Mainstem sites below the mouth of

Ironmine Creek held a high density (> 8 fish/100 ft^2) of sculpin, and substrate consisted of large particles with low embeddedness. Two portions of a sidechannel were also sampled. One was higher gradient with abundant rock > 10 inch diameter and water velocity of ca. 1.5-2.5 feet/second. Sculpin density there was 10.2 fish/100 ft^2. Immediately upstream, a lower gradient portion of the sidechannel had a velocity of ca. 0.5-1.5 feet/second and was heavily enbedded with fine sediment. Sculpin density there was 1.7 fish/100 ft^2.

Sculpin length

The smallest sculpin collected were 16 mm, at several sites, and the largest individual (at Little Wood River below Ironmine Creek) was 132 mm. Virtually all fish larger than about 100 mm displayed the red-orange edge at the top of the first dorsal fin that in other sculpin species is characteristic of males.

Length-frequency distributions (Figures 3-15) were prepared for most sites. Typically a large fraction of any group was 40-60 mm in length and probably represent fish in their second year of life. The shift from a peak at 40-60 mm at Wilson Creek in mid-July to 60-70 mm in late September (Figure 5) probably represents growth during that time period.

Fish of a size typical of young-of-the-year (assuming the late spring spawning that is typical of other sculpin species) were not collected at many sites, especially in July, and might have been too small to detect. The presence of 10-20 mm long fish at Lake Creek in early September was unexpected, and might

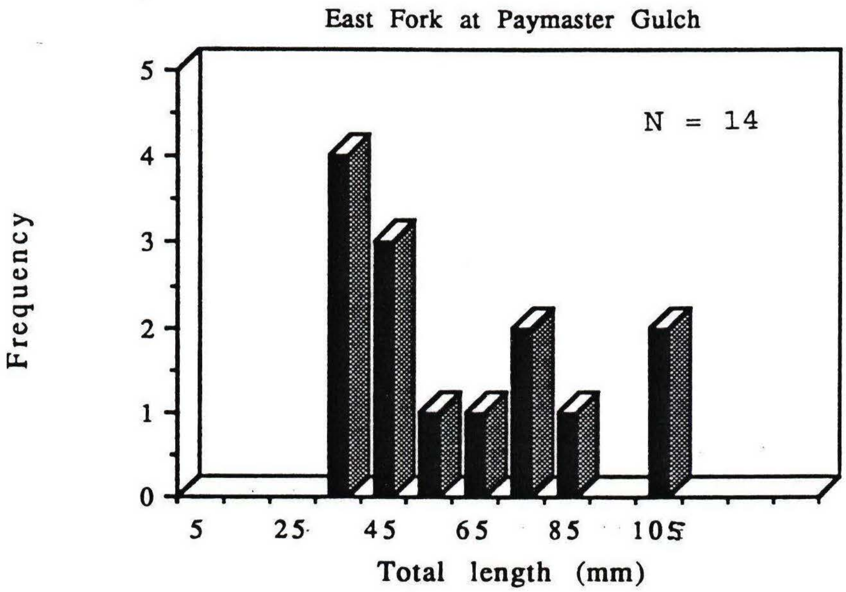
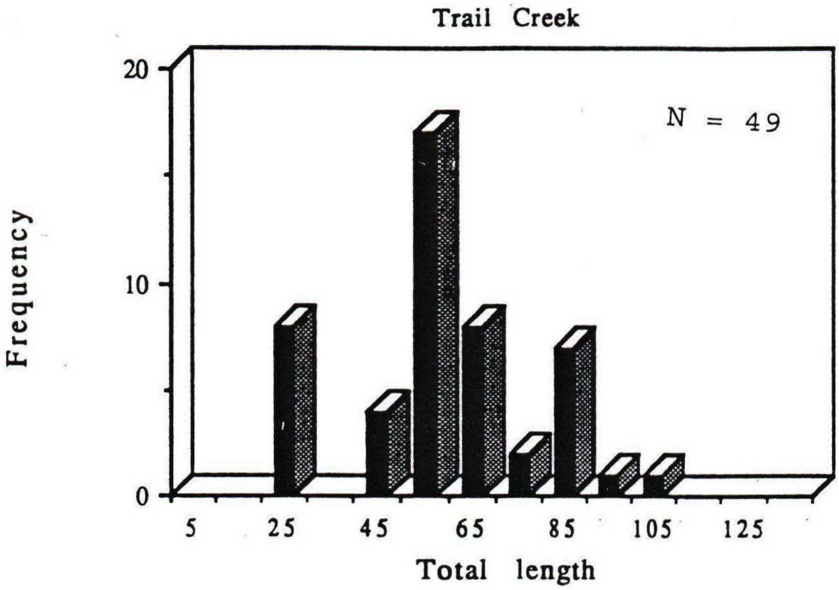


Figure 3. Length-frequency distribution of Wood River sculpin on 14 July 1996, plotted as mid-points of 10 mm length classes.



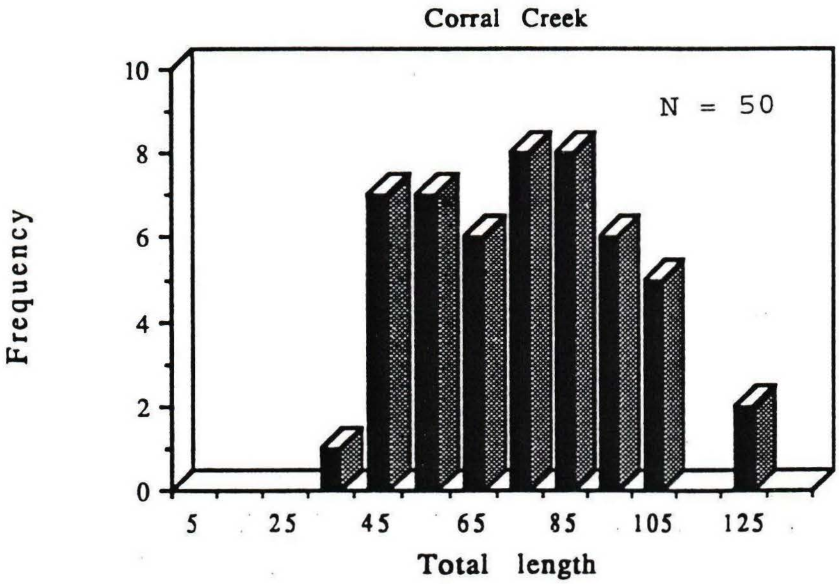


Figure 4. Length-frequency distribution of Wood River sculpin on 17-18 July 1996, plotted as mid-points of 10 mm length classes.

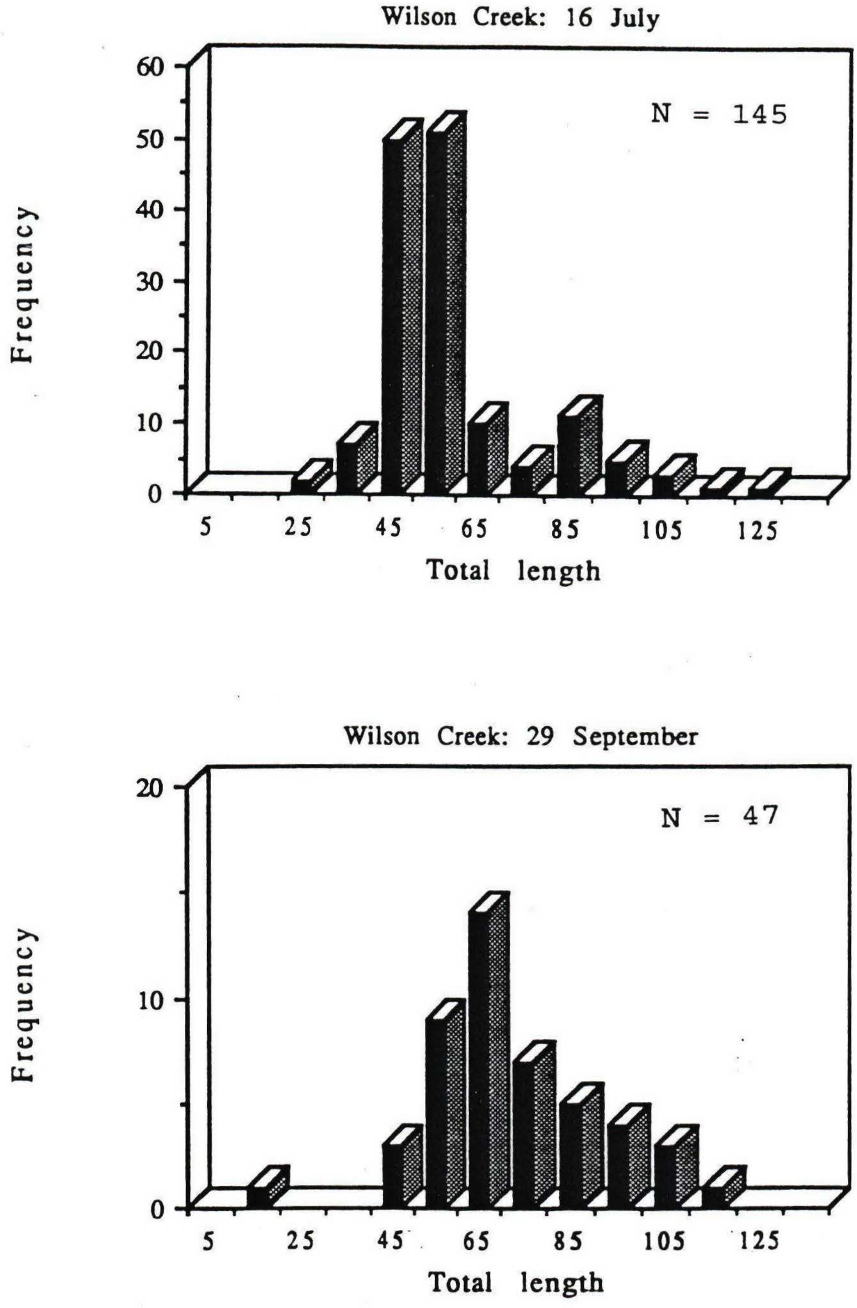
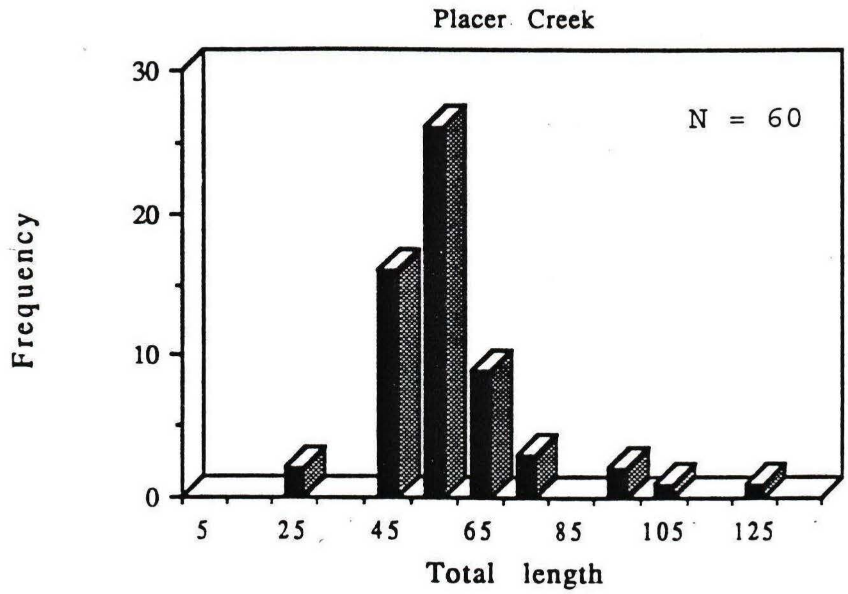


Figure 5. Length-frequency distribution of Wood River sculpin, plotted as mid-points of 10 mm length classes.



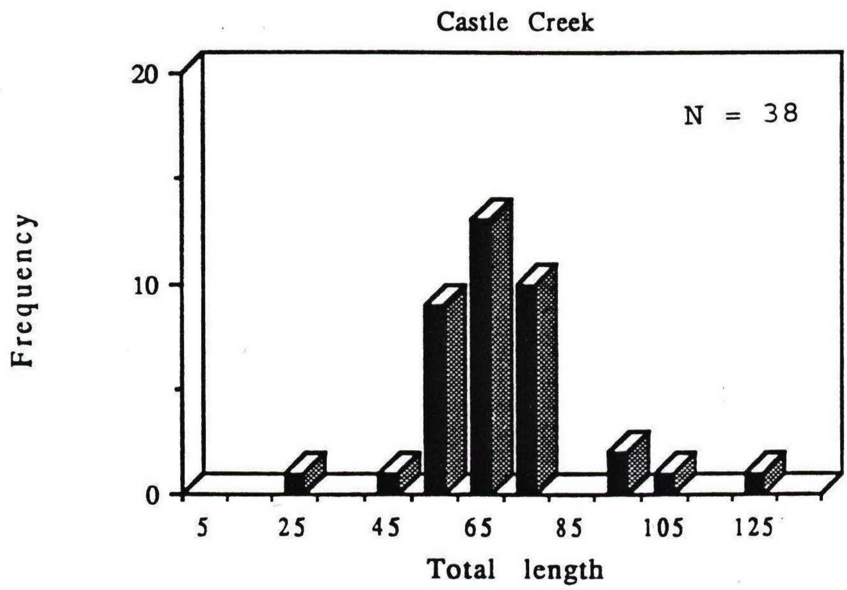


Figure 6. Length-frequency distribution of Wood River sculpin on 10-12 July 1996, plotted as mid-points of 10 mm length classes.

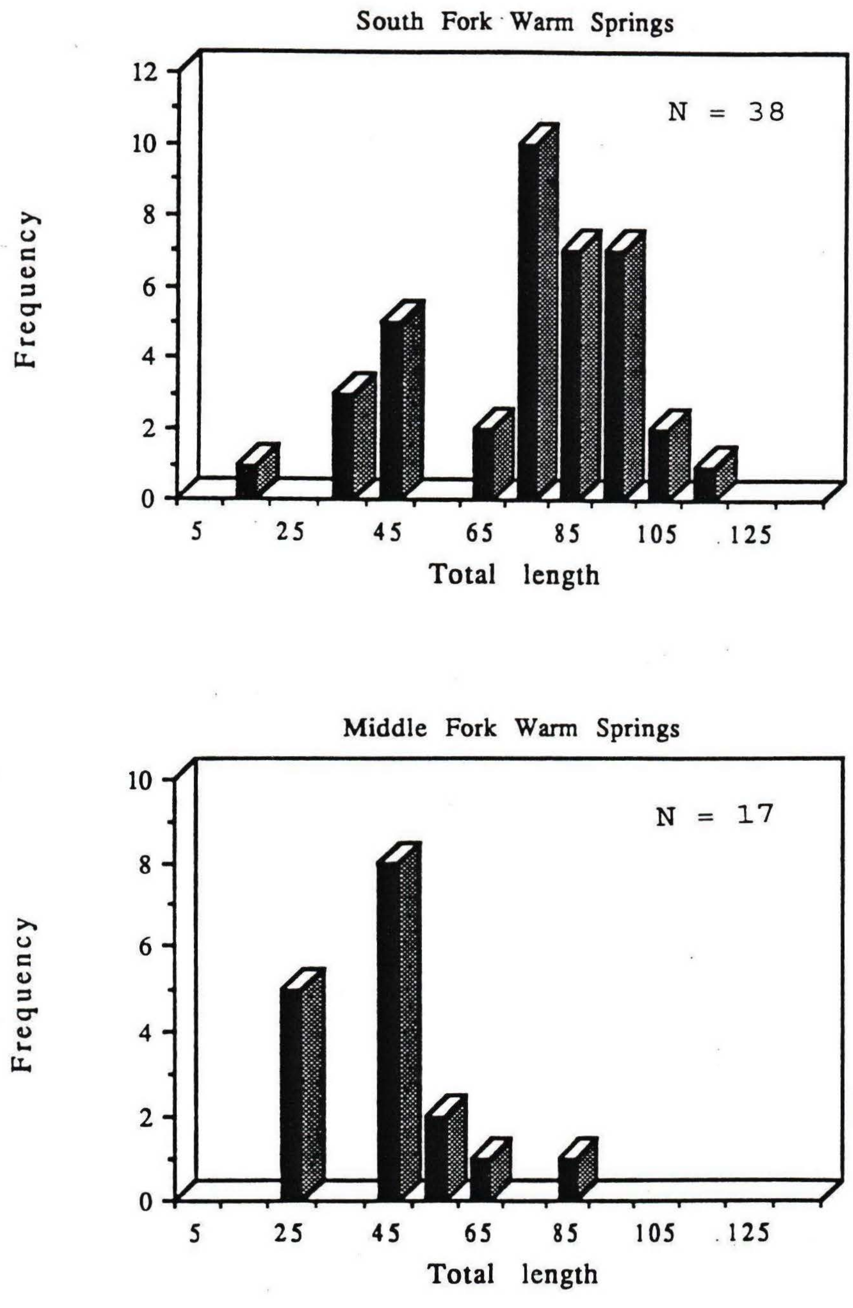


Figure 7. Length-frequency distribution of Wood River sculpin on 13-21 July 1996, plotted as mid-points of 10 mm length classes.

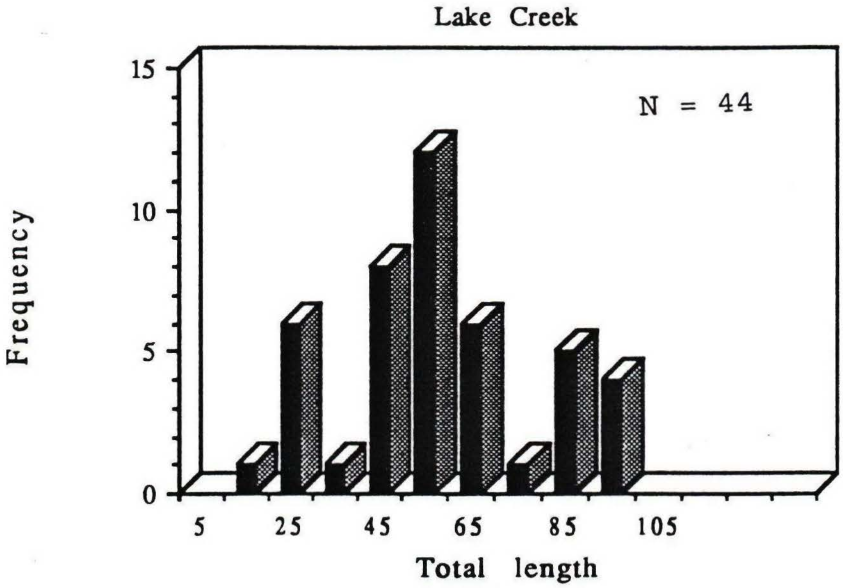


Figure 8. Length-frequency distribution of Wood River sculpin on 8 September, plotted as mid-points of 10 mm length classes.

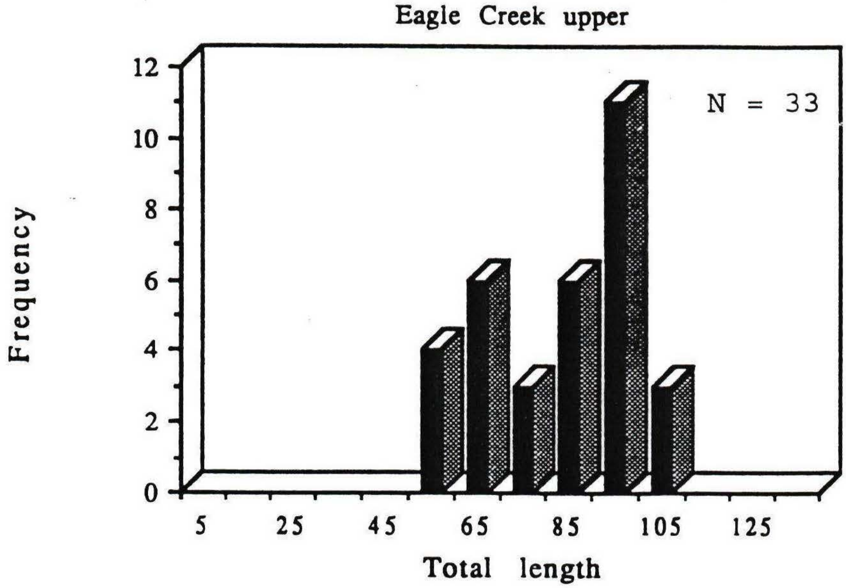
indicate some late summer spawning.

Young-of-the-year sculpin were collected at the lower portions of some streams (i.e., Eagle Creek, Figure 9) and at the upper portions of others (i.e., Owl Creek, Figure 11). They were present in shallow water with intermediate velocity, often closer to the stream margin, and were generally segregated from larger sculpin. The Copper Creek site (Figure 15) typified this situation and held the highest density of small (presamably young-of-the-year) sculpin.

Upstream limits

At the streams that were systematically checked for upstream distributional limits, a consistent pattern was observed. Sculpin abundance declined as that limit was approached, and smaller fish ceased to be found.

No sculpin were found at Coyote Creek above elevation 7520 ft, and other limits were Senate Creek, 7360 ft; upper Big Wood River near Horse Creek confluence, 7480 ft; Baker Creek, 7840 ft; main Warm Springs Creek, 7240 ft, and its tributary Placer Creek, 7160 ft. No sculpin were found above 6640 ft on Wilson Creek (Trail Creek drainge) and above 7040 ft on the East Fork Big Wood River, but a thorough upstream search was not conducted. At these locations, stream gradient typically was steepening, usually to over ca. 6%, and either a series of 1-3 ft high drops over large woody debris or a cascade over bedrock was often (but not always) present immediately upstream. Both juvenile and adult trout (brook trout at Senate Creek, the upper f9



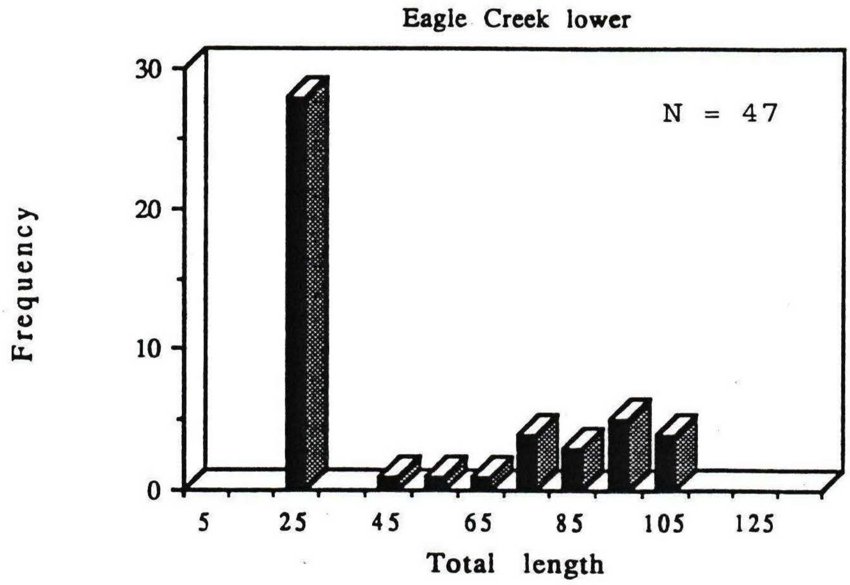


Figure 9. Length-frequency distribution of Wood River sculpin on 30 September, plotted as mid-points of 10 mm length classes.

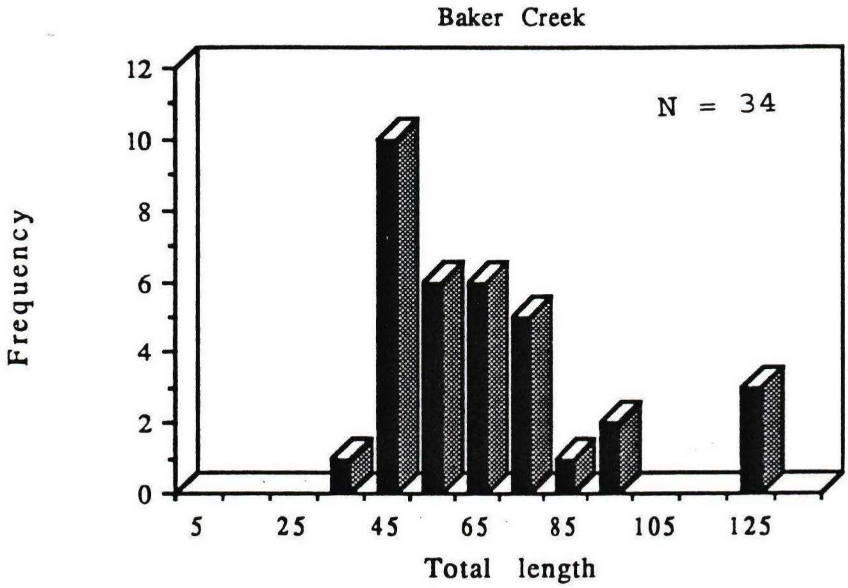
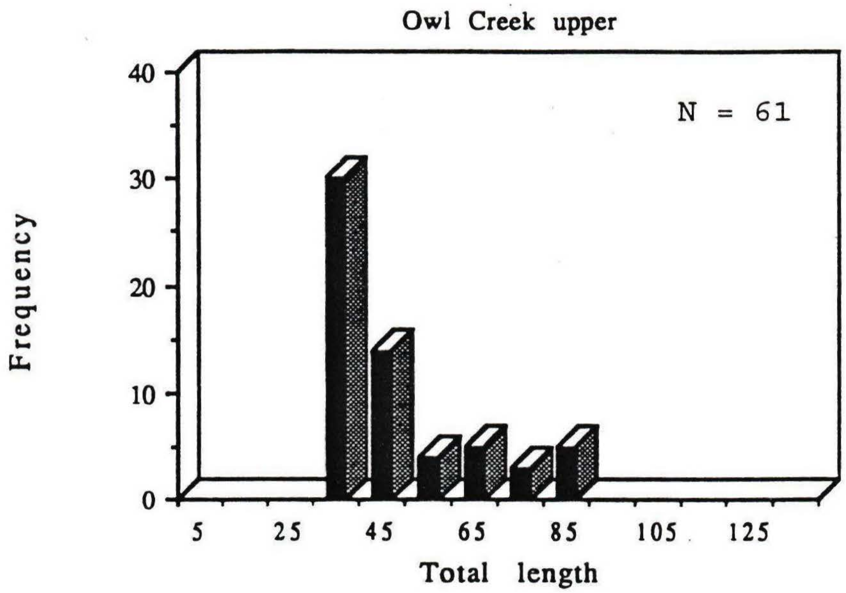


Figure 10. Length-frequency distribution of Wood River sculpin on 7 September, plotted as mid-points of 10 mm length classes.



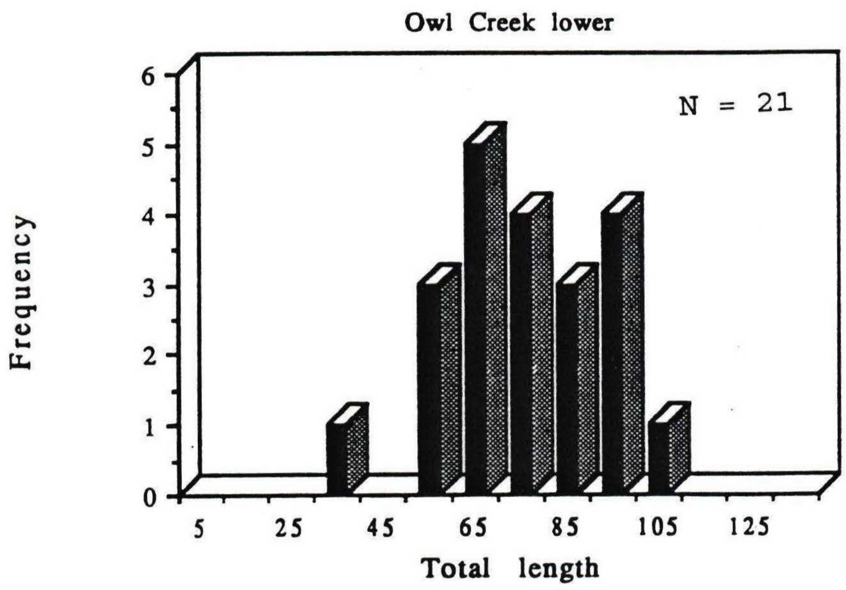


Figure 11. Length-frequency distribution of Wood River sculpin on 11 September, plotted as mid-points of 10 mm length classes.

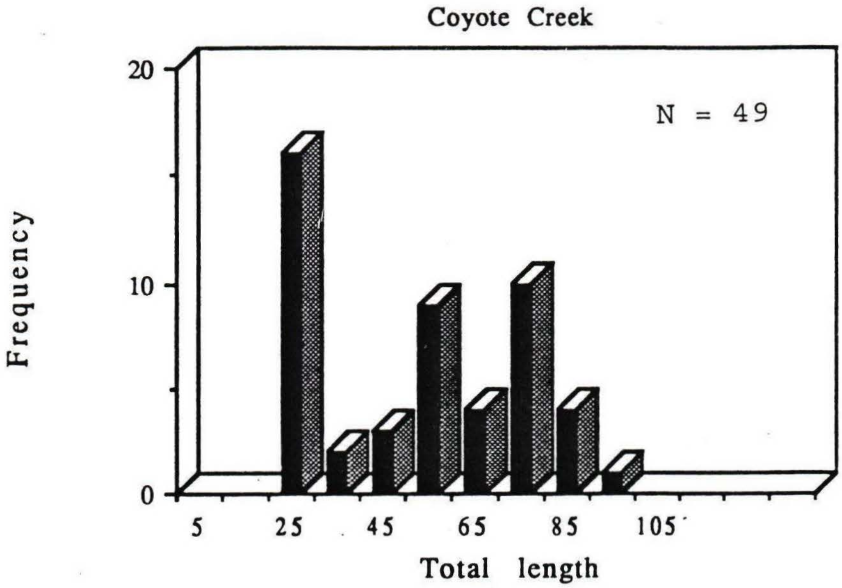


Figure 12. Length-frequency distribution of Wood River sculpin on 8-9 July, plotted as mid-points of 10 mm length classes.

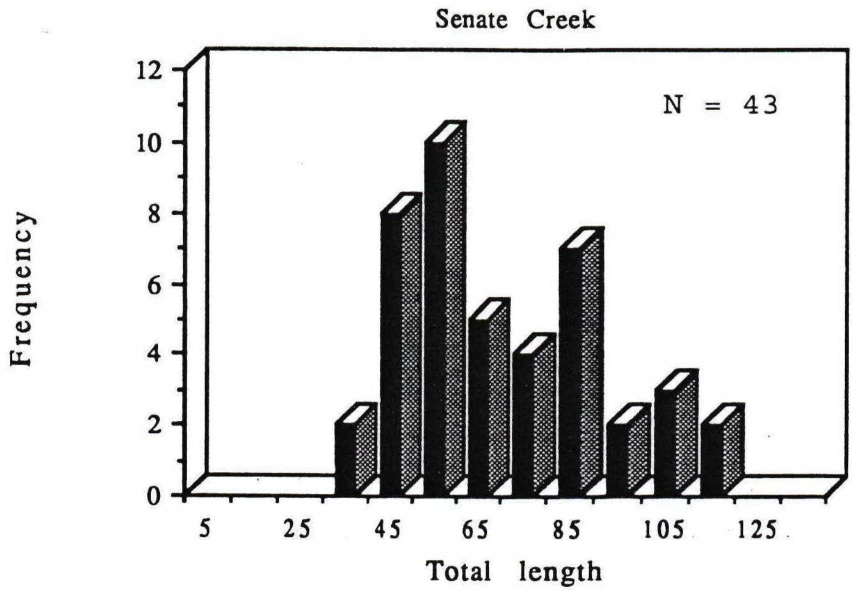


Figure 13 . Length-frequency distribution of Wood River sculpin on 10 September, plotted as mid-points of 10 mm length classes.

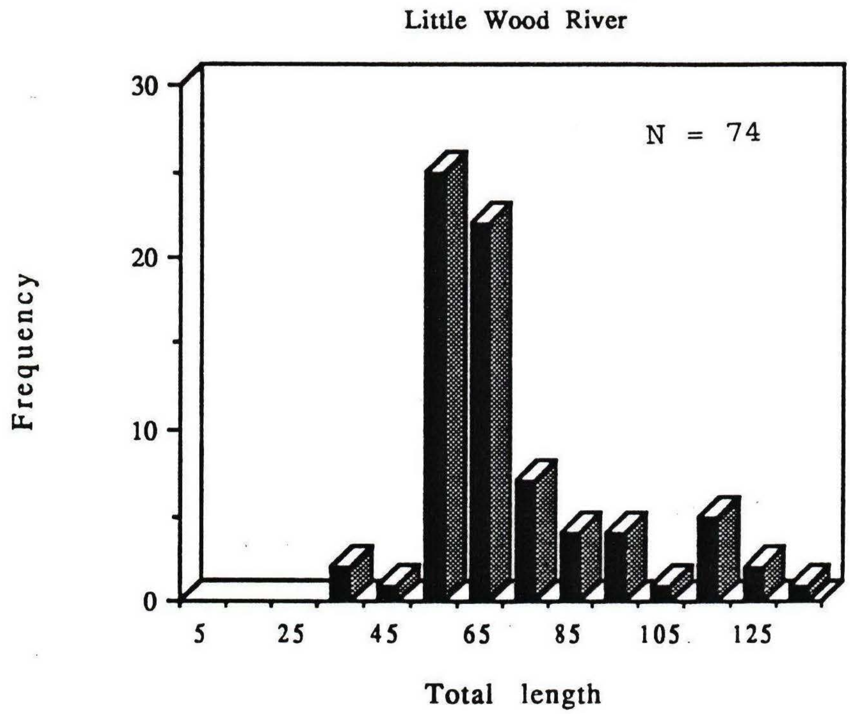
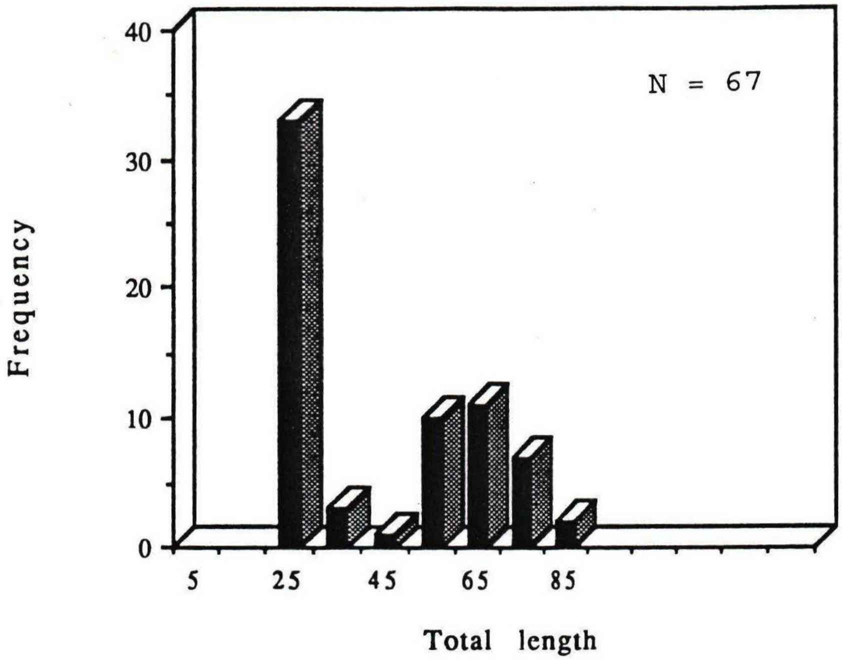


Figure 14. Length-frequency distribution of Wood River sculpin on 23 July, plotted as mid-points of 10 mm length classes.

Copper Creek



Garfield Creek

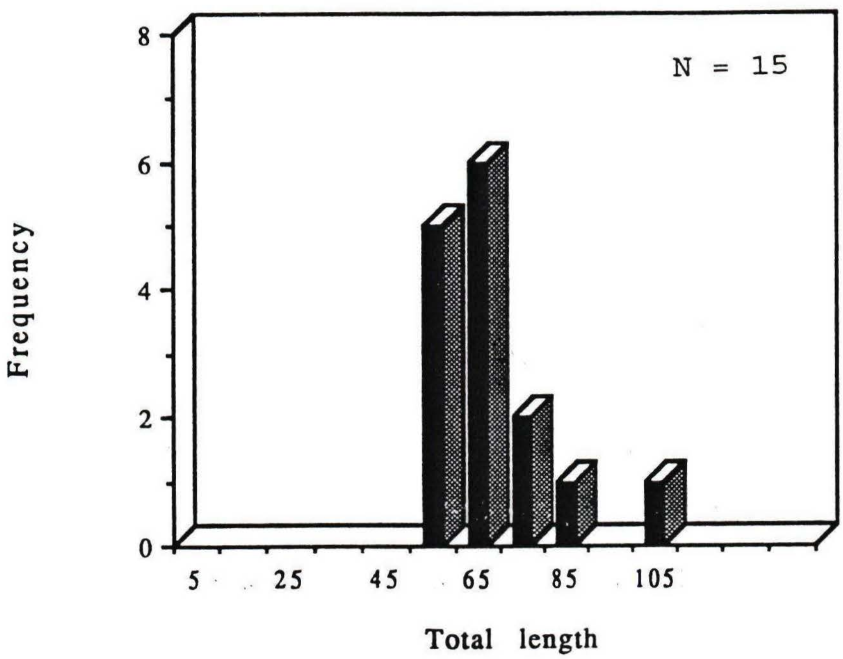


Figure 15. Length-frequency distribution of Wood River sculpin on 25 July, plotted as mid-points of 10 mm length classes.

Big Wood River, Baker Creek, and main Warm Springs Creek; rainbow trout at Placer and Wilson Creeks) were commonly found above the upstream limits of sculpin.

Eagle Creek was unique in that its entire flow became subterranean for several hundred yards at ca. 6720 ft elevation, ca. 1.8 miles upstream from the Forest boundary. No fish of any species was captured at several sites checked above that location.

Downstream limits

The downstream range of sculpin was not systematically checked, but the species was present where Deer Creek, East Fork Big Wood River, Warm Springs Creek, Copper Creek (Little Wood River drainage) and Eagle Creek flowed out of the Forest.

The exception to that pattern was Lake Creek. On 8 September, three sites were checked. At the upper site (several hundred yards below the "lakes"), sculpin density was 28.4 fish/100 ft^2, the highest density recorded during the study, and mid-day water temperature was 13 C. The middle site was established just above Sawmill Canyon, immediately below a submerged diversion that dewatered the stream by ca. one-third. Water temperature was 15 C, much of the site was shallower than 4 inches, and sculpin density was 0.6 fish/100 ft^2. The lower site, additionally dewatered, was near the mouth of Taylor Canyon. No sculpin and one brook trout were present in 200 yards of stream. Water temperature was 20 C and most of the site was ca. 2 inches deep.

Winter habitat

Deer Creek sites were re-sampled on 23 October. At the upper site (at trailhead), water temperature was 0.5 C and surface ice had formed along the stream margin. Only a few sculpin, all large adults, were present and these individuals were taken from between boulders in a deep pool. Adjacent portions of upper Deer Creek and Deer Creek at Wolftone Canyon showed the same pattern: sculpin clumped in deeper, slow pools with submerged cover and absent from all other habitat types.

On 3 November, Eagle Creek was re-sampled. Water temperature was 4 C at mid-day and no ice was present. At the lower site, sculpin density was unchanged from that in late summer, but 90% of those were present in the two pools instead of being scattered throughout the site. At the upper site, only a few small pockets of deep-slow water were available, and sculpin density had declined by 40% from summer levels. At both Eagle Creek sites, intermediate-sized sculpin were under-represented in winter; an average of 62% of the sculpin were $\geq$ 90 mm and 18% were $\leq$ 25 mm.

Other species

No other sculpin species were collected at the study sites. Apart from brook and rainbow trout (Appendix 1), Wood River sculpin coexisted in summer with no other fishes at the study sites. They were found with daces (*Rhinichthys* spp.) in Muldoon Creek (Little Wood River drainage) below the Forest boundary.

All trout collected were wild except at Baker Creek near

Norton Creek, where hatchery rainbow trout stocked as "catchables" were present.

Juvenile tailed frogs (Ascaphus truei) were found in the water at a few sites (Appendix 1) and were the only amphibians encountered.

Discussion

Wood river sculpin were abundant at most study streams and populations appeared "healthy" overall. The species is readily identified by the lack of opercular spines. A few fish were noted with a poorly developed spine on one side of the head (as also noted by Merkley and Griffith 1993). The larger (> ca. 100 mm) Wood River sculpin in many streams displayed a striking blue-green coloration to the underside of the head and anterior body.

Taxonomically, the Wood River sculpin is a member of the bairdi species group (Bailey and Bond 1963) and is closely related to the Paiute sculpin (Cottus beldingi) that is also present in portions of the Wood River system (Simpson and Wallace 1982). The Paiute sculpin has a much broader distribution, being native to the Lahontan and Bonneville basins and the Columbia River drainage, including the Snake River (Simpson and Wallace 1982), but whether it is native to the Big Wood and Little Wood rivers is unclear. During other 1996 sampling, C. beldingi was collected in upper Rock Creek, a tributary to Magic Reservoir, but not on the Forest.

Population estimation techniques used in this study appear to accurately represent sculpin abundance. Confidence intervals (Appendix 1) were narrow, the number of fish caught on an electrofishing pass never exceeded those of a prior pass, and the last pass at a site usually caught no fish (Appendix 1). In July at the lower Wilson site, the 125 sculpin captured in the three passes were marked with a temporary fin clip and released. Four hours later the block net was re-placed and the site was electrofished once. Eighty percent of the marked fish were recaptured and eight unmarked fish were collected, suggesting effective capture and minimal emigration and immigration rates.

Few previous studies have incoprorated Wood River sculpin. During summer 1992, Wood River sculpin populations on three preserves owned by The Nature Conservancy were surveyed by Merkley and Griffith (1993). Average densities were 6.8 fish/100 ft^2 at the Hemingway Preserve on the Big Wood River near Ketchum, 1.8 fish/100 ft^2 at Soldier Creek, and very low at Silver Creek. Small sculpins that were apparently young-of-the-year were found on all three Preserves in July. The majority of Wood River sculpin caught were 40-70 mm, and maximum sizes at various sites were 110-130 mm.

Bruns and Minshall (1979) reported Wood River sculpin densities at seven sites sampled in August and October-November 1977 and April 1978. Two headwater sites will be discussed below. At the remaining five sites, which were on the Big Wood River from near the mouth of Prairie Creek downstream to Hailey,

densities of under 1 fish/100 ft^2 were reported.

Wood River sculpin appear to be most abundant in larger, moderate-gradient streams if water temperatures there remain below about 15 C in summer. These characteristics are not unlike those of other sculpins in western mountain streams. Platts (1974) surveyed fish populations, including sculpin spp. (probably shorthead sculpin _Cottus_ _confusus_ and torrent sculpin _C_. _rhotheus_) in 38 tributaries to the South Fork Salmon River. Explosives were used to ensure complete capture of fishes. Sculpins were most abundant at 2-3% gradients. At steeper gradients, sculpin abundance declined and they were not found at gradients greater than 8%. In those South Fork Salmon River tributaries, sculpin were not present where stream width in summer was less than 12 feet (Platts 1974).

Wood River sculpin were present in streams above 7800 feet elevation, and are one of the few North American fishes to be found at such elevations. In South Fork Salmon River tributaries, sculpin declined in abundance above 5200 feet and were absent above 5600 feet (Platts 1974).

Conductivity/sculpin density data lend some support to the hypothesis that for streams of similar size, elevation, gradient, depth, and substrate composition, their bedrock type might effectively predict Wood River sculpin abundance. Streams with higher conductivity have elevated primary production and produce more aquatic invertebrates which in turn typically constitute the diet of sculpins, presumably including the Wood River sculpin.

Koetsier et al. (1996) found that conductivity and alkalinity were highly correlated ($r^2 = 0.96$) in six tributaries of the Salmon River, and macroinvertebrate biomass showed a significant positive relationship with alkalinity ($r^2 = 0.84$, $p < 0.05$).

Bruns and Minshall (1979) estimated Wood River sculpin abundance at a site on Coyote Creek and a site on Cherry Creek that are only a few hundred yards apart but drain different bedrock. Alkalinity of Cherry Creek was double that of Coyote Creek, and August and November macroinvertebrate biomass in the former was also double that of the latter. Bruns and Minshall (1969) also estimated sculpin density using techniques similar to those used in the present study. Cherry Creek density was 13.0 fish/100 ft^2 in October (no valid estimate in August) and Coyote Creek density was 1.7 and 1.9 fish/100 ft^2 in August and October, respectively.

Based upon the observations made during this study, the presence/absence of the largest individual sculpin at a site is dependent on the quality of stream margin conditions in summer, but overall sculpin abundance appears less sensitive than is trout abundance to streambank and riparian condition. In winter, however, Wood River sculpin appear to be much more restricted in their habitat use and the presence of pools with complex cover might prove critical to their winter survival.

Prelminary observations suggested that larger substrate and adequate water depth were important habitat attributes, and indicated that a minimum depth threshold of about 4 inches might

exist for adult sculpin. Preliminary observation also indicated that sculpin density declined at one site (upper Little Wood River) where gradient decreased and fine sediment embeddedness increased. Microhabitat analysis would be necessary to assess possible relationships of that nature.

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Appendix 1. Sampling locations at which Wood River sculpin were captured in 1996. See last page for more detailed site location.

area = area sampleed in square feet
pass 1 = number sculpin captured, first electrofishing pass
pass 2 = number captured, second pass
pass 3 = number captured, third pass
pop est = population estimate
lower and upper CI = 95% confidence intervals
density = sculpin density, fish/100 ft_2
K = water conductivity, uS
elevation = approximate elevation at middle of site
other species:
- brk = brook trout
- rbt = rainbow trout
- frog = tailed frog

Site number (from p. 1 of Appendix)	Location
1.	Deer Cr. @ mouth of Wolftone Cr.
2.	upper Deer Cr. @ trailhead (BURP site)
3.	East Fk. BWR immed. dwnstrm from Paymaster Gulch
4.	Trail Cr. 200 yd below Wilson Canyon
5.	Corral Cr. immed. above Uncle Johns Gulch
6.	Corral Cr. 0.6 mi before end FR137
7.	Wilson Cr. at access dwnstrm from Trail Cr. road
8.	Wilson Cr. immed below canyon
9.	Castle Cr. 100 yd above mouth
10.	Castle Cr. 200 yd above E Fk confluence
11.	Rough Canyon Cr. at mouth
12.	Warm Spr. Cr. 100 yd above mouth Rough Canyon
13.	Placer Cr. 100 yd above corrals
14.	Left Fork Placer Cr. at mouth
15.	Warm Spr. Cr. immed abv confl S Fk & Mid Fk
16.	Warm Spr. Cr. 50 yd abv FR227 bridge
17.	Middle Fk Warm Spr immed abv mouth
18.	Middle Fk 0.4 mi above mouth
19.	South Fk Warm Spr 150 yd abv mouth
20.	South Fk Warm Spr at Meadow Cr
21.	Lake Cr. at Sawmill Canyon
22.	Lake Cr. 260 yd below lower lake
23.	Fox Cr. 100 yd above mouth
24.	Eagle Cr. 100 yd below Neal Canyon
25.	140 yd above ford, FR144
26.	Baker Cr. 200 yd above confl Norton Cr.
27.	Baker Cr. @ mouth Lost Shirt Canyon
28.	Baker Cr. 350 yd dwnstrm from trailhead @ end FR162
29.	Owl Cr. 100 yd above mouth
30.	Owl Cr. 0.4 mi above mouth
31.	Owl Cr. 1.1 mi above mouth
32.	Owl Cr. 1.7 mi above mouth
33.	Coyote Cr. 270 yd above mouth
34.	Coyote Cr. 0.7 mi above mouth
35.	Coyote Cr. 1.0 mi above mouth
36.	Senate Cr. 200 yd above mouth
37.	Senate Cr. upper meadow, 0.6 mi abv mouth
38.	Horse Cr. immed abv confl with Big Wood R.
39.	Big Wood R. 100 yd abv confl with Horse Cr.
40.	Garfield Cr. 60 yd above Guard Station
41.	Copper Cr. 200 yd above mouth of Mormon Cr.
42.	Little Wood R. 0.5 mi abv Ironmine Can @ jct trails 173 & 179
43.	same as #42

sub-watershed	stream	site	date	area	pass1	pass 2	pass 3	pop est.	lower CI	upper CI	density	K	Elevation	gradient	other spp.
Big Wood abv Ketchum	Lake Cr.	21.Sawmill	Sept 8	1231	8	0	0	8	8	8	0.6	377	6360	3.4	brk
	Lake Cr.	22.upper	Sept 8	183	38	12	2	52	52	54	28.4	377	6480	2.8	brk
	Fox Cr.	23.lower	Sept 6	688	2	0	0	2	2	2	0.3	149	6120	2.8	rbt
	Eagle Cr.	24.lower	Sept 30	306	38	13	0	51	51	52.5	16.7	401	6300	3	brk,rbt
		25.upper	Sept 29	276	33	9	2	44	44	45.7	15.9		6560	2.7	brk
	Baker Cr.	26.Norton Gu	Sept 7	2039	12	3	0	15	15	15.6	0.7	151	7320	2.5	brk,wrbt,hrbt
		27.Lost Shirt	Sept 7	959	14	3	1	18	18	19.1	1.9	151	7740	3	brk,rbt
		28.upper	Sept 8	853	1	0	0	1	1	1	0.1		7840	5.8	brk
	Owl Cr.	29.lower	Sept 11	1075	10	2	0	12	12	12.5	1.1	153	7080	3.9	none
		30.next	Sept 11	608	12	4	1	17	17	18.5	2.8	153	7200	3.4	brk
		31.next	Sept 12	991	21	4	2	27	27	28.4	2.7	153	7280	3.4	brk
		32.upper	Sept 13	580	40	13	3	57	56	59	9.8	153	7400	2.6	brk
	Coyote Cr.	33.lower	July 8	651	11	5	2	18	18	20.4	2.8	26	7200	4.7	brk
			Sept 9	456	22	7	1	30	30	31	6.5	72	7200	4.7	brk
		34.middle	July 8	888	16	5	2	23	23	24.9	2.6	26	7300	5.4	brk
		35.upper	July 9	659	8	2	0	10	10	10.5	1.5	26	7520	7.2	none
	Senate Cr.	36.lower	Sept 10	490	5	2	0	7	7	7	1.4	210	7320	4.5	brk
		37.upper	Sept 10	365	31	5	2	38	38	39.2	10.4	234	7360	4.3	brk
	Horse Cr.	38.above BW	Oct 1	958	4	0	0	4	4	4	0.4	170	7480	3.2	brk,rbt
	BWR	39.above Hor	Oct 1	502	8	1	0	9	9	9	1.8	155	7480	4.6	brk

sub-watershed	stream	site	date	area	pass1	pass 2	pass 3	pop est.	lower CI	upper CI	density	K	Elevation	gradient	other spp.
Deer Creek		1.Wolftone	July 1	1888	7	1	0	8	8	8.3	0.4	149	5840	1.1	brk,rbt
			July 30	1888	1	0	0	1			0.1		5840	1.1	brk,rbt
			Oct 23	1888	3	0	0	3	3	3	0.2		5840	1.1	brk,rbt
		2.trailhead	July 1	600	2	1	0	3	3	4.1	0.5	134	6160	3.5	brk,rbt
			July 30	847	4	1	0	5	5	5.5	0.6	148	6160	3.5	brk,rbt
			Oct 24	847	2	0	0	2	2	2	0.2				brk,rbt
East Fork	East Fk.	3.Paymaster		714	14	5	0	19	19	20	2.7	87	7040	5.7	brk,rbt
Trail Creek	Trail creek	4.sidechanne	July 18	1368	48	14	2	64	64	65.9	4.7	164	6360	1.3	brk,rbt
	Corral Cr.	5.UJ Gulch	July 17	912	31	6	0	37	37	37.7	4.1	171	6500	4	none
	Corral Cr.	6.upper	July 17	315	19	5	1	25	25	26.2	7.9		6760	4.7	brk
		7.lower	July 16	809	73	43	9	134	125	144.1	16.6	180	6410	4.7	brk
	Wilson Cr.	lower	29 Sept	753	47	16	3	67	66	70	8.9		6410	4.7	brk
		8.upper	July 16	928	29	8	0	37	37	38	4		6640	5.7	brk
Warm Springs	Castle Cr.	9.lower	July 10	741	12	5	0	17	17	18.1	2.3	48	6640	2.1	none
		10.upper	July 10	594	19	6	1	26	26	27.4	4.4		6840	3.2	none
	Rough Can Cr	11.at mouth	July 11	138	1	0	0	1			0.1	66	6720	5.1	rbt
	main	12.abv RC	July 11	273	13	3	1	17	17	18.1	6.2	94	6720	1.6	none
	Placer Cr.	13.lower	July 12	744	36	24	4	68	61	75	9.1	54	6840	2.9	rbt
		14.upper	July 12	628	2	0	0	2			0.3	57	7160	7.6	none
	main	15.abv triple	July 11	1210	5	1	0	6	6	6.3	0.5	95	6840	5.6	brk, frog
	main	16. FR 227 b	July 13	462	6	2	0	8	8	8.7	1.7	95	7240	4	frog
	Middle Fk.	17.lower	July 13	421	9	2	0	11	11	11.5	2.6	176	6840	2.9	frog
		18.upper	July 21	390	5	1	0	6	6	6.4	1.5	165	6920	3.2	none
	South Fk.	19.lower	July 13	660	3	0	0	3			0.5	178	6840	2	brk
		20.upper	July 21	1320	18	13	3	37	34	43.8	2.8	162	6880	3.1	brk, rbt

sub-watershed	stream	site	date	area	pass1	pass 2	pass 3	pop est.	lower CI	upper CI	density	K	Elevation	gradient	other spp
Little Wood	Garfield Cr.	40.abv GS	July 25	556	15	3	0	18	18	18.5	3.2	81	6560	5.1	brk,rbt
	Copper Cr.	41.abv Morm	July 25	690	57	17	3	78	77	80.8	11.3	132	6640	1.2	rbt
	abv Ironmine	42.main	July 23	420	24	8	2	35	34	36	8.3	147	6440	2.2	rbt
		43.sidechann	July 21	449	35	9	2	46	46	47.7	10.2		6440	2.2	rbt
		sidechannel	July 21	234	3	1	0	4	4	4.7	1.7		6440	2.2	none